Resonant Mechanics & The Hydrogen Atom

A Real-Valued Wave Equation Interpretation

Zachery Claude Maarschalkerweerd Jones

Abstract

This report presents the atomic-structure implications of the *real-valued Resonant Wave Equation* in Resonant Mechanics (RM). Instead of using complex amplitudes or probabilistic wavefunctions, RM describes atoms as standing patterns of chronotactic Flow $\Phi(\mathbf{x}, \tau)$. We show that the RM wave equation reduces to the standard Schrödinger equation under constant-parameter identification, reproducing all orbital shapes and energy levels. The difference lies not in numerical prediction but in interpretation: orbitals emerge as low-shear, boundary-locked standing modes in a self-contained micro-universe. Hydrogenic atoms, multi-electron structure, and spectral data are all shown to follow directly from the RM formalism.

1 Resonant Wave Equation for Bound Coherences

The fundamental dynamical law is the **real-valued** resonant wave equation:

$$\rho_{\text{Flow}} \frac{\partial^2 \Phi}{\partial \tau^2} = c_\Theta^2 \, \nabla^2 \Phi - \frac{\partial U_{\text{eff}}(\Phi, \mathbf{x})}{\partial \Phi}, \tag{1}$$

with:

- $\Phi(\mathbf{x}, \tau)$ — chronotactic phase field,
- ρ_{Flow} — inertial phase impedance,
- c_Θ — propagation speed of chronotactic updates,
- U_{eff} — effective boundary potential.

For small oscillations around stable minima, linearize:

$$U_{\text{eff}}(\Phi, \mathbf{x}) \;\approx\; V(\mathbf{x})\, \Phi^2.$$

Assume harmonic solutions:

$$\Phi(\mathbf{x}, \tau) = f(\mathbf{x}) \cos(\omega \tau).$$

Substitution into Eq. (1) yields the stationary RM wave equation:

$$c_\Theta^2 \, \nabla^2 f(\mathbf{x}) - 2\, V(\mathbf{x})\, f(\mathbf{x}) = -\rho_{\text{Flow}} \omega^2 \, f(\mathbf{x}). \tag{2}$$

Rewrite in Schrödinger-like form:

$$-\tilde{\kappa}\, \nabla^2 f(\mathbf{x}) + V(\mathbf{x}) f(\mathbf{x}) = E\, f(\mathbf{x}), \tag{3}$$

with the identifications

$$\tilde{\kappa} = \frac{c_\Theta^2}{2}, \qquad E = \frac{1}{2} \rho_{\text{Flow}} \omega^2.$$

This is structurally identical to the normal Schrödinger equation, but:

$f(\mathbf{x})$ is not a probability amplitude; it is a standing phase field.

2 Hydrogenic Orbitals

For a hydrogen atom, take the potential:

$$V(r) = -\frac{K}{r}, \qquad K > 0.$$

Using spherical separation:

$$f(\mathbf{x}) = R_{n\ell}(r)\, Y_\ell^m(\theta, \phi),$$

the angular equation yields the spherical harmonics Y_ℓ^m.

The radial equation becomes:

$$-\tilde{\kappa} \left[\frac{d^2 R}{dr^2} + \frac{2}{r} \frac{dR}{dr} - \frac{\ell(\ell+1)}{r^2} R \right] - \frac{K}{r} R = E\, R. \tag{4}$$

Solving Eq. (4) produces:

Energy levels:

$$E_n \propto -\frac{1}{n^2}.$$

Radial modes:

$$R_{n\ell}(r) \propto \left(\frac{2r}{n a_{\text{R}}} \right)^\ell e^{-r/(n a_{\text{R}})} L_{n-\ell-1}^{2\ell+1} \left(\frac{2r}{n a_{\text{R}}} \right),$$

with resonant Bohr radius:

$$a_{\text{R}} = \frac{\tilde{\kappa}}{K}.$$

Matching parameters $\tilde{\kappa}$ and K to $\hbar^2/(2m)$ and $e^2/(4\pi\varepsilon_0)$ makes these exactly the experimentally observed orbitals.

Interpretation in RM.

- Orbitals are standing low-shear patterns of Φ.
- The hydrogen spectrum is the harmonic register of a one-boundary code.
- "Quantization" is merely the allowed integer-turn loops of phase-work.

3 Multi-Electron Atoms

For many-electron systems, introduce:

$$V_{\text{eff}}(\mathbf{x}) = V_{\text{nucleus}}(r) + V_{\text{electron boundary}}(\mathbf{x}) + V_{\text{correlation}}(\mathbf{x}).$$

The resonant stationary equation remains:

$$-\tilde{\kappa}\nabla^2 f + V_{\text{eff}} f = Ef.$$

This produces:

(i) Shell structure n, ℓ, m arise as usual from boundary separations.

(ii) Periodic table The RM standing-mode picture naturally gives:

s, p, d, f blocks, valence patterns, chemical periodicity.

(iii) Numerical predictions Atomic radii, ionization energies, and spectra match standard quantum values when effective potentials are chosen the same way (e.g. effective nuclear charge).

4 Direct Comparison to Observations

4.1 Agreement with Hydrogen Data

Line spectra:

$$E_n = -13.6 \text{ eV} \frac{1}{n^2}$$

matches all Lyman, Balmer, Paschen series.

Orbital shapes exactly match observed angular distributions and modern electronic-structure calculations.

4.2 Agreement in Multi-Electron Systems

By using V_{eff} identical to standard practice (Hartree–Fock, DFT approximations), RM reproduces:

- ionization energy trends,
- orbital radii,
- chemical periodicity,
- transition-metal filling sequences.

4.3 Where New Physics Could Appear

RM predicts deviations only when:

- chronotactic curvature is extreme (near black/white-hole dyads),
- the resonant metric is distorted,
- fine-structure constant α is perturbed.

Every laboratory atomic system lies in the "weak-curvature" regime where RM reproduces quantum results precisely.

5 Interpretation: What RM Changes

5.1 Wavefunctions as Phase Fields

Standard QM:

$$\psi(\mathbf{x}) \quad \text{probability amplitude.}$$

Resonant Mechanics:

$$f(\mathbf{x}) \quad \text{chronotactic standing field.}$$

There is no collapse, no probabilistic ontology. Only stable or unstable standing waves of structural coherence.

5.2 Atoms as Nested Universes

Each atom is a self-sustaining micro-universe:

nucleus = boundary seed, orbitals = laminar corridors, spectra = universe's harmonic fingerprint

5.3 Quantization as Harmonic Selection

Allowed modes correspond to:

$$\oint \nabla\Phi \cdot d\boldsymbol{\ell} = 2\pi n.$$

Atomic lines are "notes" played by stable chronotactic loops.

Conclusion — Meaning & Implications

The real-valued resonant wave equation of Resonant Mechanics reproduces all known atomic structure precisely when mapped onto the usual Schrödinger form. But the conceptual picture changes completely:

- Orbitals are *not* probability clouds but **standing phase patterns** of the chronotactic Field.
- Hydrogen's discrete spectrum is the simplest harmonic grammar of a self-contained micro-universe.
- Multi-electron atoms form nested coherence architectures, explaining the periodic table as a consequence of boundary-coded resonant lanes.
- Quantum mechanics appears as a limiting case of resonant laminar Flow, not a fundamental probabilistic theory.

Atoms, in this view, are miniature cosmic resonators— stable, nested universes whose internal geometry and harmonics mirror the same laws that shape galaxies and spacetime itself.

Atoms are standing universes. Orbitals are their notes. Resonance is their law.